



# *Public Protective Actions:*

## *Decision-Making in the Field*

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## *Goal*

To provide an overview of the decision-making process used by emergency responders in evaluating and selecting PPA options.



# *Objectives*

- ◆ Define the following terms and their significance in protecting the public:
  - Public Protective Actions (PPA)
  - Evacuation
  - Protection-in-Place (PIP)
- ◆ Define the following terms and their significance in PPA decision-making:
  - Acute Exposure Guideline Levels (AEGL)
  - Emergency Response Planning Guidelines (ERPG)



## *Objectives (continued)*

- ◆ Describe criteria for evaluating Protection-in-Place as a PPA option and guidelines / procedures for its implementation.
- ◆ Describe criteria for evaluating Evacuation as a PPA option and guidelines / procedures for its implementation.



# *The Eight Step Process*

1. Site Management and Control
2. Identify the Problem
3. Hazard and Risk Evaluation
4. Select Personal protective Clothing and Equipment
5. Information Management / Resource Coordination
6. Implement Response Objectives
7. Decontamination
8. Terminate the Incident



# *Site Management & Control*

- ◆ Managing the physical layout of the emergency
- ◆ Separate people from the problem
- ◆ Can't safely manage the incident if you don't have control of the scene



# *Site Management & Control*

## Site Management Tasks

- ◆ Assume command of the incident
- ◆ Safe approach & positioning
- ◆ Establish Staging, as necessary
- ◆ Establish Isolation Perimeter around site
- ◆ Establish Hazard Control Zones
- ◆ Size-up need for immediate rescue and initial Public Protective Actions



# *Site Management & Control*

## Public Protective Actions

- ◆ *Objective:* To protect employees and general public from actual or potential harm.
- ◆ Implemented after Isolation Perimeter is established and Hazard Control Zones defined.
- ◆ *Tactical Options:*
  - Evacuation
  - Sheltering-in-Place
  - Combination





# *Protective Actions*

## Observations

- ◆ There are no clear “black & white” criteria, but a lot of gray areas.
- ◆ Guidelines should not be viewed as a replacement for the IC’s view and assessment of the incident scene.
- ◆ PIP and evacuation are not mutually exclusive options, but are often implemented simultaneously and in conjunction with each other.



# *Protective Actions*

## Evaluation Factors

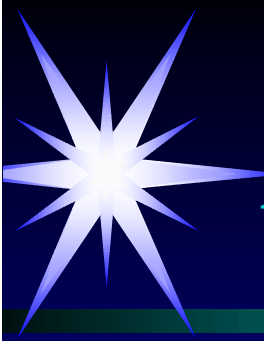
- ◆ Hazmat(s) involved.
- ◆ Population at Risk.
- ◆ Time factors involved in the release.
- ◆ Effects of present and projected meteorological conditions upon control / movement of release.
- ◆ Ability to communicate with population at risk.
- ◆ Ability of responders to implement, control, monitor and terminate the protective action.



# *Protective Actions*

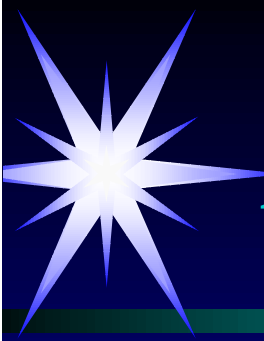
## Exposure Values

- ◆ Acute Exposure Guideline Levels (AEGGL)
- ◆ Emergency Response Planning Guidelines (ERPG)
- ◆ Immediately Dangerous to Life and Health (IDLH)
- ◆ TLV / Short Term Exposure Level (STEL)
- ◆ TLV / Ceiling (C)
- ◆ TLV / Time Weighted Average (TWA)



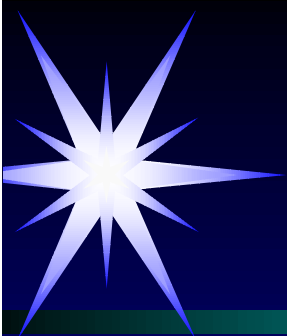
# *Acute Exposure Guideline Levels*

- ◆ Developed by EPA National Advisory Committee for AEGL's for Hazardous Substances
- ◆ Represent ceiling exposure values for general population exposure to acutely toxic HM.
- ◆ Developed for four exposure periods: 30 minutes, 1 hour, 4 hours, and 8 hours.



# *Acute Exposure Guideline Levels*

- ◆ **AEGL-1** = Airborne concentration above which the general population could experience notable discomfort.
- ◆ **AEGL-2** = Airborne concentration above which the general population could experience irreversible or otherwise serious effects or impaired ability to escape.
- ◆ **AEGL-3** = Airborne concentration above which the general population could experience life-threatening effects or death.



# *Chlorine AEGL's*

	<u><i>30 Min.</i></u>	<u><i>1 Hour</i></u>	<u><i>4 Hours</i></u>	<u><i>8 Hours</i></u>
<i>AEGL-1</i>	1 ppm	1 ppm	0.5 ppm	0.5 ppm
<i>AEGL-2</i>	3 ppm	2 ppm	1 ppm	0.7 ppm
<i>AEGL-3</i>	31 ppm	22 ppm	11 ppm	8 ppm



# *Emergency Response Plng Guideline*

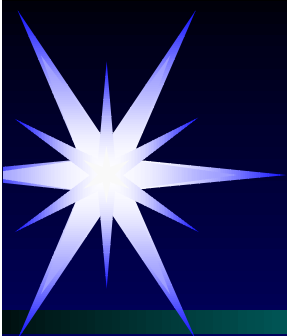
- ◆ Developed by American Industrial Hygiene Association (AIHA).
- ◆ There are three designations (ERPG-1, ERPG-2, ERPG-3).
- ◆ Developed for 1 hour exposure periods.
- ◆ Definitions parallel those of AEGL's.



# *Emergency Response Plng Guideline*

- ◆ **ERPG-1** = Concentration below which one could be exposed without experiencing other than mild, transient adverse health effects.
- ◆ **ERPG-2** = Concentration below which one could be exposed without experiencing irreversible or otherwise serious effects that could impair one's ability to take protective action.
- ◆ **ERPG-3** = Concentration below which one could be exposed without experiencing life-threatening health effects.





# *Chlorine ERPG's vs. AEGL's*

## One-Hour Exposure Comparison

● ERPG-1	1 ppm	AEGL-1	1 ppm
● ERPG-2	3 ppm	AEGL-2	2 ppm
● ERPG-3	20 ppm	AEGL-3	22 ppm



# *Protective Actions*

## Decision-Making Resources

- ◆ Pre-Incident Planning.
- ◆ Hazards analysis / consequence analysis process.
- ◆ NAERG *Table of Initial Isolation and Protective Action Distances*.
- ◆ Plume dispersion models (e.g., Aloha, Safer).
- ◆ Air monitoring results
- ◆ “Street smarts” and experience.



# *Protection-in-Place*

## The Facts

- ◆ Staying indoors can provide a safe haven during a release.
- ◆ The older the building the less effective shelter it will provide (>1 hour).
- ◆ Sustained, continuous releases will eventually filter into a structure and endanger the occupants.
- ◆ PIP is not the best option if the vapors are flammable.



# *Protection-in-Place*

## The Facts (continued)

- ◆ Weather conditions can have a positive or negative impact upon PIP effectiveness.
- ◆ HVAC systems may carry vapors into a structure before the public is warned.
- ◆ When PIP is terminated, public must be advised to “open up” their structures.



# *Protective Actions*

## Types of Structures (Rated by Energy Efficiency)

- ◆ **Type 1** - Energy efficient; constructed after 1970.
- ◆ **Type 2** - Modern construction built 1950 to 1970.
- ◆ **Type 3** - Oldest construction built 1920 to 1950.
- ◆ **Type 4** - Mobile homes, trailers, sheds, etc.  
regardless of age.



# *Protection-in-Place*

## Applicable Scenarios

- ◆ Release forms “puff” or migrating plume vs. continuous point source release.
- ◆ HM has been totally released from its container and is dissipating.
- ◆ Fast-moving toxic vapor cloud will quickly impact exposed people.
- ◆ Short duration solid or liquid leaks.



# *Protection-in-Place*

## Applicable Scenarios (continued)

- ◆ Migrating vapor cloud of known low toxicity and quantity.
- ◆ Leaks can be rapidly controlled at their source by either engineered suppression or mitigation systems, or through emergency response operations.



# *Protection-in-Place*

## Critical Success Factors

- ◆ Knowledge of HM behavior, containers and facility.
- ◆ Knowledge of types of structures in the community.
- ◆ Public have trust and confidence in responders and/or facility.
- ◆ Public has practiced and is a “player.”





# *Evacuation*

## The Facts

- ◆ Categorized as limited-scale or full-scale.
- ◆ Public safety does it every day - limited scale.
- ◆ Full-scale evacuations are difficult at best!!!
- ◆ Regardless of your decision, there will be no shortage of critics.



# *Limited-Scale Evacuation*

## Applicable Scenarios

- ◆ HM is released inside a structure and is confined.
- ◆ Flammables, explosives or reactives are involved and can explode.
- ◆ Leaks involving toxic materials cannot be controlled and are expected to continue to leak.
- ◆ IC determines the leak cannot be controlled and the public is at risk.



# *Full-Scale Evacuation*

## Applicable Scenarios

- ◆ Large leaks involving flammable or toxic gases from bulk containers or process units.
- ◆ Large quantities of HM which could explode, causing damage to additional structures, process units, etc.
- ◆ Releases which are difficult to control and which could increase in size or duration.
- ◆ IC determines the leak cannot be controlled and the public is at risk.



# *Full-Scale Evacuation*

## Evacuation Management

- ◆ *Alerting* - alert the public; tell them what to do.
- ◆ *Transportation* - move people to a safer location outside the area of risk.
- ◆ *Relocation* - keep them housed, comfortable,
- ◆ *Information* - keep them informed of your progress and of the situation.



# *Full-Scale Evacuation*

## Public Alerting

◆ There is no one best way to alert the public.

◆ Options

Personal Notifications

PA System

Tone Alerted Radios

EBS / EAS

Scanner Radio

TV Capture System

Sirens / Alarms

CT / NS



# *Decision-Making Guidelines*

## Acutely Toxic Materials

- ◆  $\leq$  ERPG-1 = No PPA required
- ◆ Between ERPG-1 and ERPG-2 = Recommend sheltering-in-place.
- ◆ Between ERPG-2 and ERPG-3 = Sheltering recommended unless situation worsens and (1) airborne concentrations approach ERPG-3, and/or (2) there is insufficient time / resources to control the emergency.



# *Decision-Making Guidelines*

## Acutely Toxic Materials

- ◆  $\geq$  ERPG-3 = Evacuation preferred unless (1) there is insufficient time before release impacts area, and/or (2) it would place ERP or public at greater risk.

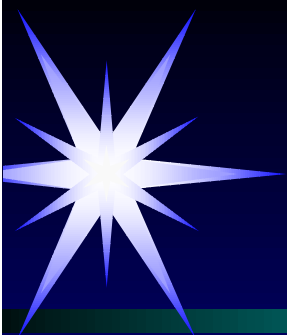


# *Decision-Making Guidelines*

## Flammable Liquids and Gases

- ◆ No health hazard (e.g., LPG, methane).
- ◆ 10% of LEL used as basis of PPA decision-making.
- ◆ Evacuation preferred unless (1) there is insufficient time before release impacts area, and/or (2) it would place ERP or public at greater risk.





# *Decision-Making Guidelines*

## Flammable Liquids / Gases (Secondary Health Hazard)

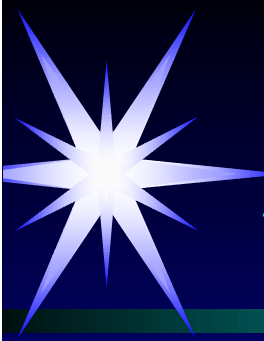
- ◆ Example: toluene, xylene.
- ◆ Initial priority to flammability, with secondary priority to health hazard.
- ◆ **HOWEVER:** Health hazard may exist with certain FL / FG at concentrations below the LEL.



# *Decision-Making Guidelines*

## Flammable Liquids / Gases (Secondary Health Hazard)

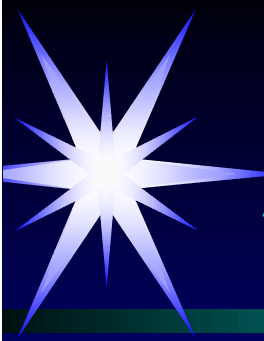
- ◆ If ERPG's are GREATER than LEL, use 10% of LEL used as basis of PPA decision-making.
- ◆ If ERPG's are LESS than LEL, use PPA action guidelines for acutely toxic materials.



# *Decision-Making Guidelines*

## Chronic Hazard Chemicals

- ◆ Example: benzene, butadiene
- ◆ Initial priority to flammability, with secondary priority to chronic health hazard.
- ◆ **HOWEVER:** Chronic health hazard may exist with certain FL / FG at concentrations below the LEL.



# *Decision-Making Guidelines*

## Chronic Hazard Chemicals

- ◆ If ERPG's are GREATER than LEL, use 10% of LEL used as basis of PPA decision-making.
- ◆ If ERPG's are LESS than LEL, use PPA action guidelines for acutely toxic materials.



# *Protective Actions*

## Lessons Learned

- ◆ Knowledge of the HM and/or facility through planning and hazards analysis is critical.
- ◆ An Incident Command organization is essential in ensuring coordination between the EOC, Command Post and field personnel.
- ◆ Establish priorities and be realistic in your expectations.



# *Protective Actions*

## Lessons Learned (continued)

- ◆ Public must have trust and confidence in the responders.
- ◆ Public needs information in a timely manner and needs to be kept informed throughout the emergency.
- ◆ What works well at 12:00 noon may be a disaster at 12:00 midnight.



# *SUMMARY*

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